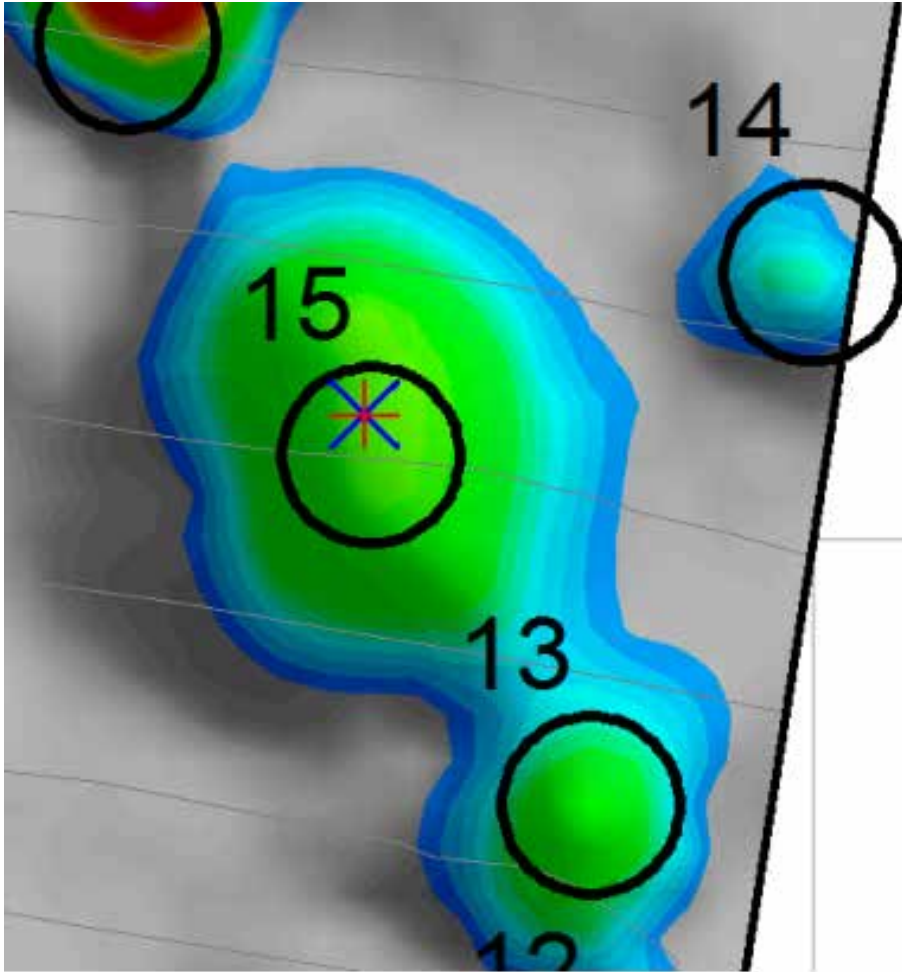




Reducing MSDs and (Debatably) Stress with AGC

SAGEEP 2025 & 3rd Munitions Response Meeting

Denver, Colorado

16 April 2025



Acronyms

- AGC = Advanced Geophysical Classification
- CSM = conceptual site model
- DGM = Digital Geophysical Mapping
- ESP = Explosives Site Plan
- ESS = Explosives Safety Submission
- ESTCP = Environmental Security and Technology Certification Program
- GCO = Geophysical Classification Organization
- HFD = Hazardous Fragment Distance
- ISO = industry standard object
- MGFD = Munition with the Greatest Fragmentation Distance
- MRS = Munitions Response Site
- MSD = Minimum Separation Distance
- PDT = Project Delivery Team
- QAPP = Quality Assurance Project Plan
- SME = Subject Matter Expert
- TOI = Target of Interest
- UXO = Unexploded Ordnance

Key Background Points

- AGC authorized as basis for flexible MSDs in 2022, in memorandum DACS-SF (800D)
- AGC demonstrated to reliably predict TOI size and depth through ESTCP live sites demonstration program
- AGC must be performed by a GCO
- GCO must have procedure for using AGC data to reduce MSDs
- Reduced MSDs not applicable to cannot analyze results
- Reduced MSDs not applicable to DGM target digs (i.e., need classification)

For more information:



DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF STAFF
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WASHINGTON DC 20310-0200

DACS-SF (800D)

MAY 03 2022

MEMORANDUM FOR SEE DISTRIBUTION

SUBJECT: Technical Memorandum – Minimum Separation Distance Reduction with Advanced Geophysical Classification

Tetra Tech Experience

- Successfully implemented on one project
 - Target population included practice bombs and rockets (MGFD = M64A1 500-lb bomb)
- Currently in planning stage for two additional projects
- Each project addresses MRSs adjacent to (or which encompass) residential areas
- Robust programmatic SOP
 - As with our other SOPs, these are “living” documents
 - Site-specific worksheet* included as attachment to the SOP
 - The worksheet is completed per MRS (for projects with multiple MRSs)
 - SOP supports use of UX Analyze, EM Class and UXO Lab

****intended to address site-specific requirement in Army HQ memorandum***

Tetra Tech Experience

ATTACHMENT A: PROJECT-SPECIFIC MSD DETAILS

This Attachment must be completed prior to submittal of the governing ESS/ESP when flexible MSDs are planned during intrusive investigations. For projects with multiple MRSs, this Attachment may be completed separately for each MRS where flexible MSDs are planned, if desired by the project team, to account for different CSMs and planned MSD bins.

Completion of this attachment may be performed by copying the required tables to a new document. Explanation or instructional text included in this attachment need not be provided as part of the required submittals.

A1 PROJECT IDENTIFYING INFORMATION

Project Name:	
Project Location:	
MRS:	
Project Type:	

A2 DELIVERABLE UNITS AND SUPPORTING MAP(S)

Supporting maps to this Attachment are provided at the end of this SOP. Additional descriptions for deliverable units in the MRS (as necessary) may be provided below.

Deliverable Unit	Description

A3 SIZE BINS AND MSDs

This section provides the MSD bins planned for the subject MRS and the basis for these MSD bins. Table A1 presents MRS-specific munitions information from the current CSM. This list is consistent with potential munitions and explosives of concern (MEC) in Section 1 of the governing ESS/ESP and Worksheet #11 in the governing project QAPP.

Table A-1. Known and Suspected Munitions

MRS	Known and Suspected Munitions

Because implementation of flexible MSDs is based on AGC results, Tetra Tech reviews the current DoD-managed TOI library for available signatures relative to the munitions listed in Table A-1. This process uses an appropriately conservative MSD when implementing a flexible MSD approach. The DoD-managed library is used as the starting point for development of the site TOI library.

Table A-2 lists the munitions (with mark/mod) from Table A-1, munitions with available signatures from the DoD-managed library to be added to the site TOI library, and the worst-case variant from both lists in terms of greatest MSD. Removed from consideration are variants from the DoD-managed library that do not fit the overall munitions usage history in the current CSM (e.g., foreign munitions).

Table A-2. Munitions for Inclusion in Site TOI Library

MRS	Munition Caliber	Table A-1 Variants	Variants for Site Library	Worst Case Munition

Using the information in Table A-2, MSD bins are proposed for use during intrusive investigation of AGC source locations. The decision logic for determining the MSD bin for each classification decision is presented in the preceding sections of this SOP. Modifications to these MSD bins may be presented in the MSD Reduction Memorandum after completion of classification. This memorandum will have been accepted by USACE prior to the start of intrusive operations within the flexible MSD deliverable unit. The MSD bins in the MSD Reduction Memorandum will supersede those in this ESS; differences in recommended MSD bins will be discussed by the project team to assess whether an amendment to the ESS is necessary.

Field operations may proceed in accordance with the governing ESS/ESP elsewhere within the MRS, as necessary, when implementing the MSD for the munition with the greatest fragmentation distance.

Table A-3 presents the proposed MSD bins for use at the MRS within the planned deliverable units. Munitions surrogates are also included in this table.

Table A-3. Project-Specific MSD bins

MRS	Bin ID	Bin Basis	Binned Classification Result	MSD (ft)

A4 FIGURES

The figures included with this SOP and attachment are included in support of the use of reduced MSDs. Table A-4 lists the figures included with this SOP as a means for verifying completeness because the number of figures may vary from one project to the next.

Table A-4. Project-Specific Figures Supporting Reduced MSDs

Figure Number	Figure Title

Considerations

- Procedure must be defensible but not overly onerous
- Planning documents must meet applicable guidance but not hinder progress
- “Target size” and “size bin” must be defined and understood by all
- Must have plan to manage large data sets and multiple size bins

Developing the Procedure

- Define size bins prior to applying criteria for reducing their MSD
- Must have objective criteria to evaluate classification result and assign target to a pre-defined size bin
- Understand match metric and how the processing software derives target size
- Don't forget about surrogates (munitions and ISOs) and mark/mod variants, as applicable
- Need process to evaluate selected source model and additional models (additional models may still yield match metric >threshold for TOI declaration)

Criterion	Problematic Outcome
Target with any model assigned to Cat0 means target ID is dug using the maximum separation distance in ESP/ESS	Diminished (if any) efficacy of AGC to reduce MSDs
Bin assignments based only on match metric	Does not consider size evaluation
Size bins established on basis of munition caliber	Impractical number of size bins, and HFD may not be proportional to caliber

Harmonizing with Guidance

Geophysical Guidance

- DACS-SF (800D) Memorandum
- DoD Quality System Requirements
- QAPP toolkits
- EM200-1-15

ESS Guidance

- DACS-SF (800D) Memorandum
- Defense Explosives Safety Regulation (DESR) 6055.09
- EM 385-1-97, and Errata Sheet #3
- Department of Army Pamphlet 385-64

Harmonizing with Guidance

From DACS-SF (800D), Section 6(b):

b. Site Specific Standard Operating Procedure must be developed. The GCO must develop a standard operating procedure (SOP) for evaluating and documenting the procedures to be used to determine the munitions and MSDs to be used in place of the DDESB-AMGFD. Because many munitions have similar diameters with different fragmentation distances, and the TOI size prediction is based on diameter, the most conservative MSD must be selected. (Selection of the most conservative MSD means within a size range, the largest possible munition must be used; if there is a question, the largest of the possible munitions will be used.) The SOP must include a procedure for determining and documenting the TOI and MSD to be used. This procedure must be submitted as part of the DDESB required explosives safety submission and approved by both the Military Services' explosives safety office and the DDESB.

Take-aways:

- **Ensure your MSD reduction SOP does not inherently set you up for inability to follow your own SOP**
- **Communicate early with Government PDT UXO SMEs**

DoD-accepted language used in ESP/ESS to meet DACS-SF (800D) requirement:

In accordance with DACS-SF Technical Memorandum, Minimum Separation Distance Reduction with Advanced Geophysical Classification (AGC), May 03, 2022, MSDs for unintentional detonations may be reduced based on analysis of AGC data concerning targets of interest (TOI) (munitions) and non-TOI (metal debris). Reduction of the MSD output will be based upon AGC predictions of the diameter of the possible munition involved for detected anomalies. Analysis of AGC data will not be used to increase the MSDs beyond that of the approved MGFD for each area. AGC results that produce a “cannot analyze” designation will be excluded from consideration for a reduced MSD. The standard operating procedure for reduction of the MSD will be provided under separate cover.

Defining the Terms

Term	Examples (to be refined by each GCO)
Size Bin	Group of munitions from the project target population, for which assigned targets can all be excavated IAW safety protocols for a single HFD. The bin includes applicable surrogates (e.g., ISOs) and mark/mod variants when the target population includes unspecified munitions. Considerations for setting size bins: • Use of engineering controls • Field operations (i.e., how will digs be prosecuted) • CSM complexity
Target size band	Targets are categorized as small, medium or large based on criteria established in the GCO procedures. Similarly, the divisions between these bands are defined in the GCO procedures. Size bands allow for size estimate comparisons during digging and anomaly resolution but are unlikely to be the same as the size bins for assigning targets for reducing MSDs. Considerations: • Inaccuracy in AGC processing software ability to predict target “size” • Risk of failure
Target size	Target size prediction from AGC processing software is defined as a function of primary polarizability from the appropriate AGC sensor time gate. Its assignment to a target size band is based on its best model match to munitions in the site library. Considerations: • Validation of scripted workflows to support automation of target assignments

Managing the Information



MRS XYZ

HFD 239' - Projectile, 75 mm, Mk 1, HE
Note: Flexible MSDs may be applied in these areas.

- Size bins can be established to optimize field operations, without sacrificing safety
- Tetra Tech's SOP worksheet includes preparation of figures to be submitted with the worksheet
- Provides graphical representation of MSD reduction zones and applicable HFD areas
- Map example is most simplistic case (i.e., one size bin for all munitions in the project target population)

Conclusions

- Use of AGC to reduce MSDs requires precise definition of size bins
- Procedures must provide rationale and steps for assigning targets to these size bins
- Overly onerous procedures and processes can negate benefits gained from flexible MSDs
- Technical and explosives safety guidance requirements must be considered together when preparing and submitting planning documents
- Engagement with PDT UXO SMEs at the onset is critical (contractor and Government SMEs)

Questions

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